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THE LIFE-HISTORIES OF THE NEW YORK SLUG CATERpillARS.—III-VI.*

(PLATES VI-IX.)

By HARRISON G. DYAR, A. M., Ph. D.

Tortricidia pallida Herrich-Schäffer.

- 1854—*Limacodes pallida* HERRICH-SCHAEFFER, Ausser. Schmett. fig. 183.
- 1854—*Limacodes flavula* HERRICH-SCHAEFFER, Ausser. Schmett. fig. 185.
- 1864—*Tortricidia pallida* and *flavula* PACKARD, Proc. Ent. Soc. Phil. III, 347.
- 1891—*Tortricidia flavula* DYAR, Psyche, VI, 128.
- 1892—*Tortricidia pallida* and *flavula* KIRBY, Cat. Lep. Het. I, 551.
- 1892—*Isa textula* MORTON, Ent. News, III, 1.
- 1892—*Tortricidia flavula* DYAR, Ent. News, III, 62.
- 1894—*Tortricidia flavula* NEUMOEGER and DYAR, Jour. N. Y. Ent. Soc. II, 75.

LARVA.

- 1891—Dyar, Psyche, VI, 145.
- 1892—Morton, Ent. News, III, 1. (as *Isa textula*).
- 1893—Packard, Proc. Am. Phil. Soc. XXXI, 104 (as young larva of *Heterogenea sp.*).
- 1893—Packard, Proc. Am. Phil. Soc. XXXI, 105 (as *Heterogenea testacea*).
- 1893—Packard, Proc. Am. Phil. Soc. XXXI, 106 (as *Heterogenes flexuosa*).
- 1894—Dyar, Ann. N. Y. Acad. Sci. VIII, 220.

SPECIAL STRUCTURAL CHARACTERS.

Dorsal space moderately broad, narrowing only a little toward the extremities, arched; lateral space broad, oblique, concave; subventral space small, retracted. Ridges slightly prominent, never tubercular, furnished with single or furcate swollen-tipped setæ in stage I, afterward smooth or with rudimentary setæ. Outline from dorsal aspect elliptical notched at the anterior part of joint 13 to form a short quadrate tail. Skin covered with close, appressed, rather large, clear granules which appear immediately after the first molt and increase slightly in number at subsequent molts. Depressed spaces large, well developed, deep with sharp perpendicular sides, the bottom flat and finely granulated. These spaces are very conspicuous and so large as to divide the coarsely granu-

* Miss Morton has given up her coöperation in these articles. The assistance which she has kindly continued to furnish me will be specially acknowledged in each case.

lar general surface into a series of latticed ridges. They are as follows: (1) large, intersegmental, angularly elliptical; (2) small, addorsal, segmental, rounded triangular; (3) under the subdorsal ridge, small, triangular, shallow; (4) large, lateral, intersegmental, elongate or narrowly elliptical; (5) of moderate size, above the lateral ridge, rounded triangular, segmental; (6) very small, shallow, alternating with the lower part of the fifth series just above the lateral ridge. In the subventral space a shallow ill-defined series (7) alternate with the spiracles, and another similar one (8) is situated below them.

This larva is throughout very smooth, the setæ practically disappearing at first molt. The coloration is green, a large red mark in the shape of an irregular diamond or large blurred cross gradually appears on the back, beginning in the form of a small patch between two yellow lines. The marking appears to be mimetic of red patches or galls on its food plants.

The larva is rather highly specialized, especially in regard to its skin structure which somewhat approaches that of *Eulimacodes*, while the setæ disappear early. Its shape, however, is quite normal and typical of the smooth Eucleids in general, and the setæ of stage I are in a less advanced degree of degeneration than in *Apoda y-inversa* or *Tortricidia fasciola*.

AFFINITIES, HABITS, ETC.

This larva is allied to the small species which I have doubtfully identified as *Heterogenea flexuosa* and doubtless also to the European *H. asella*, though this has not been examined by me. It belongs to the group of the northern smooth Eucleids, and represents a more primitive state than *Apoda* in that setæ *ia* and *ib* on joint 4 and *i* and *ii* on joints 5 to 12 are partly united into a furcate or Y-shaped spine, both limbs of equal length, whereas in *Apoda* one limb has been reduced to a slight prominence.

The moths emerge over a considerable period of time. Full grown larvæ may be found unusually early, often during July, while others do not mature till late in September. This power of early emergence gives the species a northern range. In the Adirondacks it was the only Eucleid met with. In Long Island eggs and young larvæ were found on the trees at the same time that other larvæ were matured.

The larva is a rather low feeder, occurring on higher bushes and the lower branches of trees, along the edges of woods, etc., not as a rule in very shaded locations. Rarely more than one larva is found on

the same plant. The larva remains on the back of a leaf, where its shape and coloration are adapted to its concealment.

The material from which this life history was worked out was collected by me in stage I at Keene Valley and the eggs found at Bellport, Long Island. Miss Morton endeavored to obtain fertile eggs from some cocoons which I sent her, but was unable to do so. I am indebted to Mrs. Knopf for assistance with the plate.

CRITICISM OF PREVIOUS DESCRIPTIONS.

This larva remained undescribed till very recently. In my original description I say "the usual elliptical depressions hardly distinct." This may be corrected by omitting the word "hardly." Miss Morton first described the eggs. She says they are "without form," though I should describe them as regularly elliptical and greatly flattened. I do not find them "invisible to the naked eye on the leaves" since I have found them in the woods without the aid of a lens. Dr. Packard's descriptions seem to contain but one error, besides the inaccurate nomenclature, for which I am partly responsible. His "young larva of *Heterogenea*, sp." is stage VI, and his "full-grown larva of *Heterogenea testacea*" and "larva of *Heterogenea flexuosa*?" are stage VII of *T. pallida*. The "full-grown larva of *Heterogenea*, sp." is another insect.* The error referred to is on page 105, where Dr. Packard says "there is a median dorsal row of impressed rounded warts, which do not bear bristles . . .". I think it is evident that these structures are the glandular centers of the dorsal depressed spaces, and have no homology, or even analogy with warts.

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

Egg.—Elliptical, flat, transparent on smooth green leaves, whitish translucent on whitish leaves, shining; reticulations faint, visible in a strong side light under a half inch objective as narrowly linear elongate hexagonal lines, slightly more opaque than the shell. Size 1.0 x .6 mm. Laid singly on the under side of the leaf.

Stage I.—(Plate VI, figs. 1 and 2) Elliptical, rather elongate, dorsal and lateral spaces rather broad. Along the subdorsal ridge, a row of Y-shaped setæ with expanded cleft tips, changing to two separate setæ on joints 3 and 13; two lateral setæ on joints 3 and 4; along the lateral ridge a row of single swollen-tipped setæ on joints 3 to 12.

* Doubtfully identified Journ. N. Y. Ent. Soc. III, 146, as *Heterogenea flexuosa*.

Color translucent whitish with a slight green tint after the larva has eaten. Skin smooth. Length .7 to 1.1 mm. The larva feeds normally throughout the stage.

Stage II.—Setæ rudimentary, the mature structures well assumed. More rarely distinct, short, black setæ persist, arranged two on the subdorsal ridge, one on the lateral ridge. Subdorsal ridge rather square, dorsum flat, rounded; tail quadrate, sides concave. Lateral ridge moderate, subventral region small, retracted. Depressed spaces all present as in the mature larva, deep, pit-like, the latticed ridges narrow, distinct, composed of one row of large, clear, appressed granules. Color pale greenish without marks. The larva eats a track the width of its body, but only two or three times as long as wide. Length 1.1 to 1.7 mm.

Stage III.—Elliptical, tail rounded quadrate; all pale green. Skin structure the same as before. Usually the setæ are so rudimentary as scarcely to be visible; more rarely, quite distinct. The larva has the shape and appearance of the mature form, but is without marks. Toward the end of the stage a yellow subdorsal line may appear, with a round reddish patch centrally on the back. Length 1.6 to 2.2 mm.

Stage IV.—Elliptical, both ends rounded, the anterior more obtusely; dorsum arched, the highest point a little before the middle. Ridges low, not prominent, the subventral ridge shorter than the lateral. Body smooth, not tuberculate nor scalloped, setæ nearly obsolete. Skin coarsely clear granular, except on the large depressed spaces which are arranged as in the mature larva. The granules along the lateral ridge are subpapillose, slightly divided at the tip in some cases. Subventral space more coarsely granular. Color light yellowish green, a trace of reddish along the dorsal space on joints 6 to 9. Length 2.2 to 3.3 mm.

Stage V.—Subdorsal ridge rounded, lateral moderately prominent, smooth, as before; tail subquadrate, a little contracted at the base. Green, a wine red shading occupying the dorsal space on joints 7 to 9 with traces of a yellow subdorsal line. Skin surface much as before, but the granules on the latticed ridges are more numerous, forming more than one row. They resemble angularly appressed glass beads. Setæ obsolete, scarcely discernible except at the ends of the body. Subventral depressed areas rather well developed, comma-shaped, composed of the larger upper one (7) joined to a smaller lower one (8); the granules are more pointed and less well developed than above the lateral ridge. Later, in the larva observed, the dorsal patch became pentagonal, vinous red, pale centrally and covering three greenish im-

pressed spots; broadly bordered with yellow, which color also extended along the subdorsal ridges half way to the tail. Length 3.5 to 4.7 mm.

Stage VI.—Depressed spaces deep and well marked, finely shagreened granular in the bottom. Latticed ridges coarsely densely clear granular as before. Areas in the subventral space reniform, (7) and (8) conjoined, the granulations of this space finer than above the lateral ridge. Body green, at first scarcely marked, but during the stage the dorsal red patch appears. This varies greatly in shape in different larvæ, from a small transverse bar (Plate VI, fig. 3) to a large patch covering the dorsum of joints 5 to 9 and extending part way down the sides. There is a more or less distinct yellow subdorsal line, broken where it crosses the red patch, the patch bordered with crimson and yellow. The patch is of a varying shade of purplish red with a more or less distinct central square blotch on joints 7 and 8, the enclosed depressed spaces of dorsal row (1) centered with a dark dot. The patch may have an irregular outline as in the mature larva, but it does not reach either extremity. A small reddish patch may occur on joint 3. Length 4.7 to 6.7 mm.

Stage VII.—Smoothly rounded, elliptical, the tail subquadrate; highest through joint 5, evenly rounded (Plate VI, fig. 5). Subdorsal ridge rounded, dorsal space rather narrow, lateral broad, gradually sloping. Lateral ridge smooth, prominent, exceeding the subventral ridge. Subventral space small, hollowed. Depressed spaces large and deep, arranged as described above (Plate VI, fig. 8), their bottoms finely granular. Latticed ridges coarsely clear granular. Body green with a large dorsal marking which varies from narrow (Plate VI, fig. 6) to broad* (Plate VI, fig. 7) and from bright red to dull purplish in different examples. It has a pale salmon colored center, often square and covering only one depressed space (joints 7-8) or rarely larger, occasionally wanting. The patch is bordered with crimson and yellow and is usually darker around the edge and on the latticed ridges. It usually narrows on joints 3 to 5, widens again, reaching the lateral depressed space (4) on joints 5-6, is incised in a curve and broadens to the lateral margin at joint 8; narrows again in an incised curve to the depressed space (4) on joints 9-10, and there tapers to the tail, thus forming a large, blurred red cross. Most of the depressed spaces on the sides are pale with darker green centers. Length of the larva 6.7 to 9.5 mm.

* It is difficult to illustrate the range in the size of this marking without a long series of figures. The patch may be even larger than shown in figure 7.

Cocoon.—With the characters of the group.

Food-plants.—Oak, wild cherry, birch, maple, chestnut and witch-hazel have been observed.

EXPLANATION OF PLATE VI.

Fig. 1. Larva in stage I, dorsal view enlarged.

" 2. The same, side view.

" 3. Young larva $\times 5$, the dorsal marking just starting.

" 4. The same, older $\times 5$.

" 5. Side view of mature larva, anterior end to the right.

" 6. Mature larva, enlarged, restricted pattern.

" 7. Another larva, broad pattern.

" 8. Larva, dorsal view, showing the depressed spaces of dorsal and lateral areas; *a*, dorsal depressions (1); *b*, addorsal (2); *c*, upper lateral segmental (3); *d*, lateral depressions (4); *e*, lower segmental lateral (5); *f*, lower intersegmental lateral depressions (6).

The left side of joint 7 (third abdominal segment) illustrates the granulation.

" 9. *T. pallida*, imago.

Eulimacodes scapha Harris.

1855—*Limacodes undifera* WALKER, Cat. Brit. Mus. pt. V, 1149.

1864—*Limacodes scapha* WALSH, Proc. Bost. Soc. Nat. Hist. IX, 298.

1864—*Limacodes scapha* PACKARD, Proc. Ent. Soc. Phil. III, 341.

1878—*Eulimacodes scapha* MOESCHLER, Verh. Zool.-bot. Ges. Wien, XXVII, 672.

1882—*Limacodes* (*Eulimacodes*) *scapha* GROTE, Check List, 17.

1891—*Limacodes scapha* SMITH, List, Lep. 28.

1892—*Eulimacodes scapha* KIRBY, Cat. 1 ep. Het. I, 535.

1894—*Eulimacodes scapha* NEUMOEGER & DYAR, Journ. N. Y. Ent. Soc. II, 73.

LARVA.

1841—HARRIS, Rept. Ins. Mass. 303.

1864—PACKARD, Proc. Ent. Soc. Phil. III, 341.

1869—HARRIS, Ent. Corr. pl. 3, fig. 8.

1873—STRETCH, Zyg. & Bomb. N. A. 201.

1881—PACKARD, Bull. 7, U. S. Ent. Comm. 77.

1883—EDWARDS & ELLIOT, Papilio, III, 128.

1885—DIMMOCK, Psyche, IV, 279.

1885—HUBBARD, Ins. Affect. Orange, 144.

1890—PACKARD, 5th Rept. U. S. Ent. Comm. 147, 490.

1893—PACKARD, Proc. Am. Phil. Soc. XXXI, 98.

1894—DYAR, Ann. N. Y. Acad. Sci. VIII, 223.

1895—COMSTOCK, Guide Stud. Ins. fig. 257.

SPECIAL STRUCTURAL CHARACTERS.

Dorsal area broad, narrowing before to a rounded margin on joint 3, narrowing behind to a point in the tail-like termination of joint 13. Lateral area absent, the subdorsal and lateral ridges at first closely approximate, later fused into a single, sharp, high, rounded ridge. Subventral area broad, forming all the sides, perpendicular, flat or hollowed, highest in the middle, diminishing to almost nothing at both extremities. Subventral ridge very slight, just indicated at the lower edge of the body. Primitive first stage absent, the warts present in stage I reduced by degeneration, bearing two setæ, uniformly developed; in the later stages disappearing, the rudimentary setæ persistent. Subventral row represented by small setae. Both the lateral and subdorsal warts are situated on the single subdorsal ridge. Depressed areas strongly developed but scarcely sunken, flat, plate-like, shagreened and with angular margins; the dorsal row (1) elongate transversely, hexagonal, the addorsal (2) small, rounded triangular; those of the lateral area wanting; subventral plates fully developed, rounded angular, the upper subventral (7) large, ovate, the lower (8) rounded triangular; two other small rows above the subventral edge (9), and near the spiracles (10). Skin at first almost smooth, but soon covered with granules which are flattened, appressed and rounded and appear as if overlapping like the scales on a fish, on the sides from below upward, outwardly from the middle of the dorsum to the upper side of the subdorsal ridge where the two directions of scaling meet. The scaling is only present on the latticed ridges between the closely set, slightly sunken armor plates (metamorphosed depressed areas). There is a slight hump or rounded angulation on the ridge at joints 7-8, but this may be absent or there may be two such humps, the second at the junction of joints 8 and 9. Just under the edge of the subdorsal ridge from side view is a series of glandular spots which can secrete drops of a clear odoriferous fluid. They are situated above and a little before the upper side of the large intersegmental plates (7) and appear in the cast skin as round beads. It is possible that they represent the depressed spaces of lateral area.

The coloration is adapted for concealment, the green ground work variously patched and spotted with yellowish and brown being obscure on the leaves toward autumn. The peculiar square box-like shape, produced by the union of subdorsal and lateral ridges, may be of use in suggesting to its enemies an appearance unlike that of most insect larvæ, more unusual indeed than the majority of Eucleidæ.

This larva is on the whole the most highly specialized North American Eucleid. It belongs to the group of smooth Eucleids, but is the only one in which the primitive first stage has disappeared. Though it lacks the specializations of the spined Eucleids, it exceeds them by the number of its peculiar modifications, namely, the union of the ridges to the exclusion of the lateral space, the high modification and development of the depressed spaces and the conversion of the skin granules into scales.

AFFINITIES, HABITS, ETC.

The genus *Eulimacodes* was founded by Moeschler on a species from Surinam. A larva apparently identical with our *scapha* is figured by Sepp (Suranim. Vlinders, Pl. 129) from this locality, but the moth, which he calls *gibbosa*, is quite distinct. Of our two species one is found in Arizona and doubtless occurs farther south. Therefore we may regard the present species, *scapha*, to be of South American origin and we should not expect to find it represented in the European fauna.

The moths fly in July and the larval stages occupy the summer months, the insects reaching maturity in August and September. The eggs are laid singly and the larvæ live on the under sides of the leaves, solitary, though not greatly scattered, as often several or many occur on the same plant.

There is a wide range in variation with something of a local tendency. In Long Island the form with smooth subdorsal ridge is common, with no hump or only one small one (Plate VII, fig. 13). The back is green or variously spotted with yellow and brown, rarely entirely brown, the sides generally green. In the wooded parks near New York the single or double humped form is more common, often with brown markings on the sides. The larva shown in fig. 14 was collected at Fort Lee, N. J., and a curious example with two humps on one ridge and but one on the other occurred at Scarsdale, N. Y. I have collected a long series with a wide range in variation near Woodstock in Greene county.

I am indebted to Miss Morton for a number of young larvæ and to Mr. Doll for fertile eggs and cocoons. Mrs. Knopf has kindly assisted with the plate.

CRITICISM OF PREVIOUS DESCRIPTIONS.

We have several recognizable figures of this peculiar larva, but no full account of its life history. Dr. Packard describes two of the early stages, calling them "II?" and "IV, or that before the last." I infer from the

measurements given that they really were stages IV and V. Two of the references include a general account of the finer external structure. A general and not unnatural error has been made in considering the sunken armor plates to represent the segments. Edwards and Elliot say "the *segments* are arranged like the plates of a tortoise," Dr. Packard refers to a marking "along the *sutures* . . . of the segments," and I have said "joints 3 to 13 have each a plate." These structures are situated between the segments, overlapping on two adjoining ones. Dr. Packard found but seven spiracles; but he must have had before him an abnormal larva, as all my specimens possess the usual number.

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

Egg.—Elliptical, flat, 1.8 x 1.2 mm., the skin very thin, white and iridescent; the fresh egg is transparent with a slight pale yellow tint when laid on glass and becoming more opaque as the embryo develops but not darkening in color. Reticulations rounded, obscure, rarely angular, not characteristic; the surface of the egg is slightly shagreened. Another egg measured 1.7 x 1.4 x .1 mm. Laid singly on the leaves.

Stage I.—Elliptical, more pointed behind than before; dorsum flat, a little arched, separated from the perpendicular sides by a ridge bearing two rows of tubercles,* each with two setæ (Plate VII, figs. 1 to 3). These represent the usual subdorsal and lateral rows, but situated in close approximation to each other. On joint 3 are four tubercles, on joint 4, three, and on joint 13, three. A subventral row of simple setæ. The shape is less boat-like than the mature larva, though all the essential features are indicated. Pale yellowish, a broad dark band along the ridge below the skin and therefore appearing in a slightly different position according to the point of view. The band is connected with its fellow at the ends and also by a bar in the center of the dorsum. Dorsal skin smooth, depressed in gentle hollows representing the dorsal (1) and addorsal (2) depressed spaces; bases of tubercles wrinkled, subgranular; lateral (subventral) skin also smooth, with two rows of faint depressions. Venter clearer yellow than the body; head pale. Length 1.2 to 1.9 mm. The larva feeds in this stage.

Stage II.—Tubercles absent, a single tiny seta represents each. Subdorsal ridge rounded, prominent. Dorsum hollowed, sides perpendicular. Skin obscurely granular, the granules flattened, nearly contiguous, not really overlapping but suggesting scales, especially before

the larva is filled out by feeding. Depressed areas irregularly sculptured, creased, regular, the dorsal (1) transversely elongate, hexagonal, addorsal small, rounded; latticed ridges very narrow, almost linear, but the areas not much depressed. Sides hollowed below the round bulging ridge, which has a segmental row of round clear glandular areas on its lower aspect; surface slightly granular without well-defined sculpturing, two angular areas just indicated, the upper (7) pentagonal, the lower (8) rounded. Color greenish, the ridge broadly brown with the connecting band as before at the highest part of the dorsum. The back is a little angled at the segment posterior to this band (joints 7-8). Length 1.8 to 2.9 mm.

Stage III.—Much as before, but the depressed areas or plates are better defined. They are large, almost contiguous, still somewhat depressed, irregularly shagreened, the narrow latticed ridges, and especially the high bulging subdorsal ridge, distinctly scaled as in the full-grown larva. The dorsal plates (1) have a paired character as seen by a central line and two glandular dots on each side (Pl. VII, fig. 7). On the sides the plates are depressed, not very distinctly bounded. There can be distinguished besides those formerly seen (7 and 8) also a small segmental row just above the subventral edge (9). Dorsal and lateral areas sunken, ridge prominent, rounded, smooth. Shape elliptical, square anteriorly, tail obtusely pointed, the back evenly arching from head to tail. Coloration at first as before, but soon the great diversity in individual markings appears. In three larvæ from eggs laid by the same moth, three types appeared. The sides in all remained pale green, but the back was variously marked with reddish-brown. The extent of variation is from the minimum of a line along the subdorsal ridge with connecting transverse bar to the maximum of a complete brown dorsal space. Length 2.9 to 3.9 mm.

Stage IV.—The larva now exactly resembles the mature form except in size. The plates are quite distinct and the scale-like skin granules well developed. Markings better defined than before and as various as at maturity. Length 3.9 to 5.6 mm.

Stage V.—Head greenish-white, eye black, jaws brown with two black bands; palpi pale. All the plates are distinct (Plate VII, figs. 7 and 8), the scaling as in the mature larva. Plates shagreened, scarcely sunken, the dorsal ones (1) divided by a slight raised line. Hump on joints 7-8 quite well marked, but varying in different larvæ; tail round pointed. In an example selected for description the dorsum was creamy-brown, the ridge above, all the dorsal latticed ridges and a nar-

row dorsal line on the second to eighth plates dark-brown; hump opposite fifth plate very dark; glandular centers of plates also dark; a white spot in the ridge at the eighth plate (joint 10-11) and a little one at the seventh plate best seen from the side. First dorsal plate and all the sides dark leaf-green, the glandular centers of the upper plates (7) dark. Length 5.6 to 7.9 mm.

Stage VI.—Shape and markings as in the next stage. The last four stages are throughout practically alike. Length, 7.3-12 mm.

Stage VII.—Elliptical, ending in a pointed tail; dorsum slightly concave (Plate VII, fig. 6) lowest along a line just above the subdorsal ridge where the dorsal and lateral scaling meets, greatly arched; sides perpendicular, concave, diminishing at each end and without ridges, the whole shape box-like. Setæ fine and obscure, a single one on the dorsal and lateral aspect of the ridge and a few microscopic ones on the sides near the spiracle, the latter secondary. Depressed spaces converted into scarcely sunken angular plates, the dorsal ones (Plate VII, fig. 7) suggesting the plates of a tortoise. A row of ten segmentary glands on the lower side of the subdorsal ridge secrete an odoriferous fluid when the larva is irritated. Plates as described above, the latticed ridges scaled, the two directions meeting at the lowest point of the dorsum (Plate VII, fig. 11); scales arranged as if overlapping (Plate VII, fig. 12); plates irregularly finely granular (Plate VII, fig. 12). Setæ weak, normal (Plate VII, fig. 5). Opposite the fifth dorsal plate the ridge is thrown into a prominence more or less distinct, sometimes also one at the sixth plate (Plate VII, fig. 14). These humps are intersegmental, representing the incisures of joints 7-8 and 8-9. A white spot on the ridge at eighth plate. Color very variable, scarcely two specimens alike. Ground color green, more or less replaced on the dorsum by brown or yellow or both, variously mottled and spotted, the latticed ridges and glandular spots darker usually. Sides less commonly marked with brown, but occasionally so and independently of the dorsum. The order of appearance of the dark marks is from the hump and white spot, spreading on the dorsal area, and from the middle of the subventral edge and the white spot, spreading on the lateral area. I have not seen either an entirely green or entirely brown specimen. Length, 12 to 18 mm.

Food-plants.—Various shrubs and trees. Oak, chestnut, wild cherry, hickory, sweet gum, bayberry, linden, witch hazel and hop horn-bean have been noted by me.

EXPLANATION OF PLATE VII.

- Fig. 1. Larva in stage I, dorsal view, enlarged.
 " 2. One tubercle, more enlarged.
 " 3. Stage I, side view, semidiagrammatic, to show arrangement of tubercles.
 " 4. Young larva, stage IV, enlarged.
 " 5. Seta of subdorsal ridge, mature larva.
 " 6. Front view, stage VI, showing the high ridge and hollow dorsal area.
 " 7. Dorsal view, stage VI, showing the armor plates and their arrangement.
 " 8. The same, side view, showing the plates of subventral area.
 " 9. Feeding traces on a small white oak leaf.
 " 10. *Eulimacodes scapha*.
 " 11. Skin on dorsum, a portion of one segment showing part of two plates, the latticed ridge between and the addorsal plate as far as the subdorsal ridge.
 " 12. The joining of the scaled latticed ridge and the armor plate, more enlarged.
 " 13. Mature larva, slightly enlarged, Long Island form, without humps.
 " 14. The same, two-humped form from Fort Lee.

Phobetron pithecium *Smith & Abbot.*

- 1797—*Phalana pithecium* SMITH & ABBOT, Lep. Ins. Georgia, II, pl. 74.
 1827—*Phobetron abbotana* HÜBNER, VERZ. bek. Schmett. 398.
 1841—*Ecnomida pithecium* WESTWOOD, Nat. Lib. Exot. Moths, 183.
 1841—*Limacodes pithecium* HARRIS, Rep. Ins. Mass, 304.
 1864—*Phobetron pithecium* PACKARD, Proc. Ent. Soc. Phil. III, 340.
 1864—*Thyridopteryx nigricans* PACKARD, Proc. Ent. Soc. Phil. III, 350.
 1864—*Limacodes hyalinus* WALSH, Proc. Boston Soc. Nat. Hist. IX, 299.
 1864—*Limacodes tetradactylus* WALSH, Proc. Boston Soc. Nat. Hist. IX, 300.
 1869—*Limacodes pithecium* HARRIS, Ent. Corr. 244.
 1885—*Phobetron pithecium* DIMMOCK, Psyche IV, 280.
 1894—*Phobetron pithecium* NEUMOEGER & DYAR, Journ. N. Y. Ent. Soc. II, 70.

LARVA.

- 1797—SMITH & ABBOT, Lep. Ins. Georgia, pl. 74.
 1841—HARRIS, Ins. Inj. Veg. 304.
 1856—FITCH, Third Report Ins. N. Y. 381.
 1858—DUNCAN, Nat. Lib. XX, pl. 21.
 1862—MORRIS, Synop. Lep. N. A. 127.
 1863—WALSH, Proc. Bost. Soc. Nat. Hist. IX, 297.
 1870—RILEY, Am. Entomol. II, fig. 209.
 1872—LINTNER, 26th Rept. N. Y. State Cab. Nat. Hist. 149.
 1881—PACKARD, Ins. Inj. Forest Trees, 47.
 1883—SAUNDERS, Ins. Inj. Fruits, 112.
 1885—HUBBARD, Ins. Affecting Orange, 143.
 1889—LINTNER, 5th Rept. N. Y. State Entomol. 184.
 1893—PACKARD, Proc. Am. Phil. Soc. XXXI, 97 and 101.
 1894—DYAR, Ann. N. Y. Acad. Sci. VIII, 218.

SPECIAL STRUCTURAL CHARACTERS.

Outline rounded quadrangular, exclusive of the appendages, dorsal space broad, even, flat; lateral space broad, subventral comparatively broad, continuous with the lateral space, not retracted. Ridges practically absent, the subdorsal indicated by the change in direction of slope between back and sides. Tubercles greatly modified: stage I represents a primitive first stage, but tubercles i and ii on abdomen, ia and ib, iia and iib on thorax are completely united into a single spine, probably by a process, such as is indicated by the Y-shaped and pronged setæ of *T. pallida* and *T. fasciola*. Tubercle iii of joint 5 is absent. After stage I the setæ reappear double, normal. The ultimate structure of the warts, which appear at first molt, is remarkable. The subdorsal series are attached by very broad bases, greatly encroaching on the dorsal and lateral spaces, and are produced laterally into fleshy appendages of different lengths. These appendages are constricted at about the center of the attachment; the basal part bears seta i in its center; the terminal part bears seta ii at the apex. The lateral row of warts form small, rounded, button-like structures, concealed for a long time beneath the large subdorsal appendages. These warts of both rows are composed of soft spongy tissue and they readily become detached at their bases, leaving a small denuded area, which does not bleed. If the appendages are detached toward maturity, they are not regenerated; but if early in life a partial regeneration occurs at each molt, so that the structure may attain nearly its normal appearance. The subdorsal warts are each pushed a little forward so as to partially cover the segment in front. The warts bear at first stiff, smooth, pale setæ. Gradually a series of fine, secondary, branched hairs (Plate VIII, fig. 11) appears, and in the last stage, completely replaces the primary coating, leaving only the primitive setæ and a few club-shaped black hairs, which represent the last degenerate form of the original coating. In the case of the lateral horns the change from simple to fine branched hairs at the last molt is more sudden. The skin is covered with a sparse coating of fine black hairs from large tubercles (Plate VIII, fig. 15). The depressed spaces are hardly represented at all; the spiracular series (7) only is faintly shown. The appendages are formed by the subdorsal horns of joints 4 to 12 inclusive; all the others form warts of the small button-like type.

This curious larva seems to mimic a dead dry leaf. In respect to its adaptive characters it is highly specialized, perhaps the most highly specialized of any Eucleid; yet in respect to its setæ it is very primitive. It belongs distinctly to the section of spined larvæ from the absence of

a tubercle of the lateral row on joint 5, and the moving up of the spiracle; yet it is without stinging spines, the warts are hairy, a primitive first stage is present as in no other spined Eucleid, and the arrangement of the warts on the thorax corresponds strictly with that of the smooth Eucleids, there being three well developed warts on joints 3 and 4. It is, therefore, a generalized form, a connecting link between the groups of Eucleidæ and of particular interest. If we disregard its special adaptation, which is unique, this form represents the early stem of the spined Eucleids, at a time before the primitive first stage was lost, before the setæ had become poisonous spines and while the original number of warts were yet present on the thorax. It is only slightly removed from the stem of the smooth Eucleids, differing from them in the specialization of joint 5, the complete coalescence of setæ i and ii in stage I, and in the only partial degeneration of the original setæ* of the warts, which is complete in the smooth Eucleids, but in *Phobetrion* advances slowly throughout ontogeny. The number of larval stages appears to be abnormally large. I have not specially investigated the constancy of this number.

AFFINITIES, HABITS, ETC.

The allies of this larva are to be found in South America. Stoll figures the larva of *hipparchia* exactly like that of *pithecium*, as far as can be seen from the figure. We have also in Florida the species *beutenmuelleri*, which seems nearly allied, though the larva is unknown. The habits are in general similar to those of the other Eucleidæ. The eggs are laid singly, and the larvæ live on the under sides of the leaves till the last stage, where they rest on the upper side and feed fully exposed. Full grown larvæ may be found during September; the eggs are laid in July, and there is but a single brood.

The full grown larva strikingly resembles a part of a dead leaf which had fallen on the surface of the foliage.

For material I am indebted to Miss Morton for the eggs and stages I and II, which she obtained from moths bred from cocoons which I sent her for that purpose. I have also found the larva as young as stage III, at Bellport, Long Island. Mrs. Knopf kindly made the original drawings of figures 2 to 7, 13 and 14 of the plate.

*The primary setæ remain on the warts, single; the secondary wart hairs degenerate and almost completely disappear in the last stage; the final coating of fine hairs is, therefore, tertiary, and belongs to the special adaptations.

CRITICISM OF PREVIOUS DESCRIPTIONS.

There are no descriptions of the youngest stages of this species. The references given above cover descriptions and figures of the mature larva, many of them inadequate. Walsh describes a larva as *tetradactylus* with but four pairs of long appendages instead of six. I think he had before him a specimen in which the appendages of joint 8 were broken off on both sides, which would leave "the third and sixth pairs" long as he describes, if the missing appendages be not counted. This is very probable, as I often find larvæ in various degrees of dilapidation. A specimen occurred in which all the appendages were absent except the last two pairs. It was a hardly recognizable object, yet alive and healthy. I have also recorded* an example in which the third appendage (joint 6) was absent on both sides.

Dr. Packard described a larva as "*Phobetron*, sp.," apparently regarding it as distinct from the common form; but his brief description contradicts *pithecium* in nothing. This larva is said to possess some stinging power, but Dr. Packard figures no stinging spines among his excellent plates (Proc. Am. Phil. Soc., xxxi, pl. II and III, figs. 11 and 12), and I have been unable to find any such on the larva.

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

Egg.—Flat, circular, not elliptical as usual, scarcely shining, dark ocher yellow, almost brownish; diameter 1.2 to 1.4 mm., height about .1 mm. Reticulations rounded hexagonal, regular, very obscure scarcely defined lines resembling the joinings of cells. Laid singly, very rarely two overlapping. The developing embryo finally causes the egg to turn dark brown. Hatches in 10 days.

Stage I.—Rounded elliptical, the spaces proportioned about as in the mature larva, on joints 3 and 4 are three, on joint 5 one, and on joints 6 to 13, two each of long spines, subequal, composed of a tapering proximal portion with enlarged base and more slender tapering distal portion (plate, figs. 1 and 2). Of the subdorsal row, those on joints 7, 9 and 11 lean outwardly, alternating with the others. All have the bases slightly wrinkled. Below the spiracles a series of setæ arise from the subventral edge. Color dark brown, darkest along the subdorsal ridges; a broad whitish dorsal line. Spines white at base, the ends of the proximal part (hypertrophied tubercle) black, the distal part (seta) dusky, both finely spinulose. Head blackish, especially on the vertex.

When first hatched, the tubercles are small and bear only the dusky

* Ann. New York Academy of Sciences, VIII, 218, note 2.

setæ, shorter than the white hairs of subventral row ; but soon the tubercles elongate, forming the pale basal portion of the spine. Skin smooth, slightly shining. The larva feeds in this stage. Length 1.2 to 1.8 mm.

Stage II.—Instead of the spines of the subdorsal row are now present on joints 4 to 12 a series of laterally extended, short, conic, fleshy appendages, projecting about half their length beyond the sides ; those on joints 7, 9 and 11 much shorter than the others, which are of equal length ; all densely covered with coarse, smooth, pale spines. The other setæ, namely all those of joint 3, the lateral row and those on joint 13 form small pale tubercles, with a single hair, inconspicuous, being obscured by the appendages of the subdorsal row. Color dead-leaf brown, the tips of the appendages whitish, the outline evenly fringed by the white spines. Dorsal space narrow, clothed by a few small dark setæ. On the sides, owing to the broad attachment of the subdorsal appendages, the lateral space occupies but one-third, the subventral space two-thirds of the area, both perpendicular. Lateral area brown ; subventral dull whitish. Length 1.8 to 2.5 mm.

Stage III.—(Plate VIII, fig. 3) Elliptical, the back flat, produced by laterally extended appendages ; side area small. Appendages as before, but longer, each slightly constricted near the base, rather sparsely covered with stiff, pale setæ, arising from conical bases. Yellowish-brown, a double blackish spot on the top of each appendage, the tips pale ; subventral edge white. A tuft of fine short hairs in the center of each segment of dorsal space. Lateral tubercles with single seta ; subventral setæ double. Head testaceous, the eye black. Length 2.5 to 3.5 mm.

Stage IV.—Appearance as before, but the horns are more densely covered with the sharp stiff, pale-yellowish setæ. The basal portion of each horn is divided off by a constriction, approximately bisecting the short horns. The horn on joint 11 is proportionately longer than before ; otherwise as in the previous stage. Color brown, fringed by the pale spines, the long horns shaded in a darker tint. Length 3.5 to 5 mm.

Stage V.—(Plate VIII, fig. 4) The discrepancy in the sizes of the horns has increased. Those on joints 6, 8 and 10 are elongated, those on joints 7 and 9 remain short and that on joint 11 is about as long as the one on joint 12. The lateral tubercles are almost invisible, being covered up by the subdorsal ones ; but they are furnished with a crown of stiff hairs besides the central seta. Color brown, the horns darker

with a central pale line and pale tip ; setæ pale, simple as before, but supplemented by many very fine short curved hairs, also simple. The primitive setæ may be distinguished, arranged as in the mature larva, i on the basal portion, ii on the apex of the subdorsal horns. Length 5 to 7 mm.

Stage VI.—Long horns longer, short ones shorter in proportion than before, the second, third and fifth pairs (joints 5, 6 and 8) curved backward, sickle-shaped the seventh pair (joint 10) forward. Nine pairs visible from above, first and eighth short, fourth and sixth very short. Each has a distinct constricted basal piece, the terminal setæ of both portions arising from a round tubercle. Horns covered with large stiff, smooth, pale setæ and also with fine, short, broadly branched hairs which become very dense at the apices of the long horns, giving the appearance of rusty brown tips. On the short horns these fine setæ are few or absent. A few dark hairs on the dorsum as before. Lateral horns and the lower ones of thorax short, conic, with many pale spines and a pale bare tip. Color brown, the horns darker with a white stripe up the middle. Subventral area broadly white. As the larva grows the bases of the subdorsal horns swell up on the lower side. Length 6.5 to 8.5 mm.

Stage VII.—Shape and proportions of the appendages much as in the mature larva, but slenderer and the posterior ones less closely applied to each other. The first, second, third and fifth pairs curve backward, the seventh and eighth forward, the tenth pair is just visible from above. Clothing of the horns more modified than before. The fine brown branching secondary hairs are thick, especially along the anterior edges of the long horns ; the coarse pale hairs are still present about as before on the basal pieces and short horns, but on the long horns outwardly reduced in number and partly converted into long pale setæ irregularly spinulated toward the tip on one side. Lateral tubercles with a bare tip, from which arises the primitive seta, surrounded by a circle of stiff hairs. Color brown, the horns darker, a pale gray line up the middle of each, furcate on the basal pieces ; subventral edge white. The long white hairs are on the posterior edge of the horns, away from the greatest number of fine brown hairs. Length 8 to 10 mm.

Stage VIII.—All pale whitish brown with scarcely any marks. Hair clothing almost exactly as before, except for the addition of a few black, club-shaped spinulated hairs (Plate VIII, fig. 12) on the long horns. Seta ii of subdorsal row on the long horns arises from a bare cone surrounded by a brush of little black spines. Lateral row well

spined, but the spines all simple, the seta from a bare cone as before. The coarse setæ on the horns still present, rather less in number than before, and the fine branched hairs are more numerous. The long horns bear six kinds of hairs in this stage: (1) the primitive setæ, (2) the smooth pale setæ, (3) the long pale spinulated hairs, (4) the fine felted secondary hairs, (5) the club-shaped black hairs and (6) the fine spines on the tip. Length 10 to 13.5 mm.

Stage IX.—(Plate VIII, figs. 5, 6 and 7) Shape as described above. The third, fifth and seventh pairs of appendages longest, second and eighth next, first, fourth, sixth and ninth short. The side view (Plate VIII, fig. 6) shows how these may be variously elevated by the larva. The body is sparsely clothed with fine dark setæ (Plate VIII, fig. 15), the appendages both of subdorsal and lateral rows covered only with the fine branched secondary hairs (Plate VIII, fig. 11). The primitive setæ remain and at the tips of subdorsal horns a circle of very short black branched hairs (Plate VIII, fig. 10). These are absent on the side horns (Plate VIII, fig. 8). The black club-shaped hairs also remain, irregularly scattered toward the tips of the long horns; but all of the stiff pale setæ are absent. Any of the appendages of either row may be detached by slight force. They leave a bare area, and the subdorsal ones show a double attachment (Plate VIII, fig. 9) corresponding to setæ i and ii. The larva is quite uniformly colored, varying from tan color to purplish brown. The subventral edge is usually broadly white and the sides and under sides of the horns darker than the upper surface. The fine hairs on the horns are so dense and closely felted that they give the shape to the appendages as shown in the figures 5, 6 and 7. Length of larva 13.5 to 22 mm.

Cocoon.—As usual except that as all the tubercles are shed at the time of spinning, they remain on the outside of the structure and give it a characteristic appearance.

Food-plants.—Various low shrubs and the lower branches of trees. I have records of oak, chestnut, sassafras, dogwood and ash.

EXPLANATION OF PLATE VIII.

- Fig. 1. Diagram of stage I, side view, showing the arrangement of the setæ.
" 2. Stage I, two-thirds view $\times 17.5$.
" 3. Stage III, dorsal view $\times 10$.
" 4. Stage V, dorsal view $\times 5$.
" 5. Front view of mature larva enlarged.
" 6. Side view of same.
" 7. Dorsal view of the same $\times 2.5$.

Fig. 8. One of the warts of the lateral row enlarged.

" 9. One of the long horns (detached) of subdorsal row, enlarged, ventral view, showing the double attachment.

" 10. The terminal seta (ii) and the area immediately around it from the tip of one of the long appendages.

" 11. One of the branched secondary hairs of the thick coating of the appendages $\times 175$.

" 12. Apex of one of the club-shaped hairs which remain on the long appendages in the last stage $\times 200$.

" 13. Male moth, *Phobetron pithecium*.

" 14. Female moth, " "

" 15. A group of the skin setæ with their tubercles.

Sisyrosea textula HERRICH-SCHAEFFER.

1854—*Limacodes textula* HERRICH-SCHAEFFER, Ausser. Schmett. fig. 184.

1864—*Isa textula* PACKARD, Proc. Ent. Soc. Phil. III, 347.

1867—*Limacodes inornata* GROTE & ROBINSON, Ann. Lyc. Nat. Hist. N. Y. VIII, 372.

1876—*Sisyrosea inornata* GROTE, Can. Ent. VIII, 112.

1882—*Sisyrosea inornata* GROTE, Check List, 17.

1891—*Isa inornata* DYAR, Ent. News, II, 156.

1891—*Isa inornata* SMITH, Check List, 28.

1892—*Sosiosa textula* KIRBY, Cat. Lep. Het, I, 551.

1894—*Sisyrosea inornata* NEUMOEGER & DYAR, Journ. N. Y. Ent. Soc. II, 70.

LARVA.

1869—HARRIS, Ent. Corresp. pl. ii, fig. 7; pl. iii, fig. 6.

1887—HULST, Ent. Amer. III, 66.

1889—DYAR, Can. Ent. XXI, 77.

1893—BEUTENMUELLER, Bull. Amer. Mus. Nat. Hist. V, 89.

1893—PACKARD, Proc. Am. Phil. Soc. XXXI, 97; pl. iv, figs. 13, 14.

1894—DYAR, Ann. N. Y. Acad. Sci. VIII, 219.

SPECIAL STRUCTURAL CHARACTERS.

Dorsal space narrow, especially centrally, lateral space broad, very oblique, subventral space very small, retracted; form much flattened, the principal part of the visible surface consisting of the lateral spaces. Outline elliptical; subdorsal ridge slight, lateral pronounced. Horns of both ridges extended laterally, those of the subdorsal ridge reduced in size, flattened, subequal, those of joints 8 and 10 slightly shorter. Lateral horns produced and flattened, slender, fringing the sides and touching the leaf when the larva is at rest, subequal, those of joints 13 slightly longer. The spines on the horns are of the normal stinging type after stage I, but not strongly developed and they tend to degener-

ate in the later stages, their piercing caps being partly replaced by setæ. Those on the red anterior edge are shortened and darkened by black pigment. The arrangement of the horns is normal for the spined Eucleids, a single segmentary subdorsal row on joints 3 to 13 and single lateral row on joints 3, 4, 6 to 12. In stage I the horns are surmounted by a central swollen-tipped seta and a small series arranged around it in a radiating circle. Skin covered by a series of curious wavy folds which extend on the horns also, but less distinctly. This structure is unique and its origin obscure, though it seems to be produced by the ordinary skin granules becoming concave and their raised edges confluent.

Depressed spaces represented by whitish rings with dark centers, fairly well developed; (1) and (2) are situated closely in line in the small dorsal space, both paired; (4) and (6) are situated on the posterior half of the segment in the lateral space in two small areas devoid of green pigment, which are connected narrowly along the incisure; (5) is small and round, situated below (6) just above the base of the lateral horn toward the front edge of the segment. Subventral space without distinct marking. The spiracle on joint 5 is situated above the line of the lateral horns, nearly uniform with the white spots (5); those on joints 6 to 12 are below the horns, well hidden in the retracted subventral space. No caltropes or detachable spines are present. This highly specialized larva departs widely from its congeners in many respects. Its form is unique and its skin structure much more specialized than any of the other spined Eucleids. The horns are nearly equally developed, and in this respect the larva is more generalized than its allies, as also the presence of more than three setæ on the horns in stage I, indicating less advance in the degeneration of this stage. The peculiar lateral direction of the horns is somewhat paralleled in *Phobetron*, though this does not indicate any close relation between these insects, since the hairs are in one case primitive setæ and in the other degenerating spines. The coloration is protective, and together with the peculiar shape enables the larva to escape observation to a sufficient extent.

AFFINITIES, HABITS, ETC.

With the possible exception of *S. nasoni*, the larva of which is unknown, the present species has no near allies in our fauna. Belonging as it does to the spined Eucleids, its origin may be traced to the South. Not improbably this type of larva will be found to occur in the tropics of America, but at present I know of none.

S. textula is single brooded. The moths emerge rather late in the

season—during July. The eggs are laid singly and well scattered. The young larvæ after emergence from the egg rest at the edge of the leaf on the under side and moult at once without feeding. During their life history they remain on the under side of the leaves, finally falling to the ground to spin their cocoons during September. They occur on forest and shade trees, not usually on very low bushes.

There are eight larval stages normally, occasionally nine, the extra stage being interpolated between the last two as in *Euclea*.

The present life-history was worked out from a newly hatched larva which I found on a white oak leaf at Bellport, Long Island, resting beside its egg shell.

CRITICISM OF PREVIOUS DESCRIPTIONS.

Harris' figures are good. In the colored one the yellow subdorsal line is omitted, while in the structural one the thoracic region is not properly segmented. Dr. Hulst describes the *head* as "strongly bifid, etc.," evidently referring to the anterior edge of joint 3; otherwise the description is excellent. In my own first general description I omitted to mention the subdorsal horns. In my later one I located the second and third subdorsal pair too far forward (they are on joints 4 and 5, not on 3 and 4 with a gap at 5 as I stated), and I mistook the lower lateral segmental glandular dots (5) for spiracles on joints 6 to 12, thus placing them above, instead of below, the lateral horns. Mr. Beutenmueller locates the red marks on segments 8 and 10 instead of 9 and 11, probably owing to a failure to recognize the true relations of the anterior horns. Dr. Packard treats this species with unusual brevity, confining his remarks to an explanation of the figures of the spines of the lateral horns. Yet, curiously enough, an error has crept in, for the figure is stated to represent "one of the lateral tubercles of the first abdominal segment" (joint 5), which really bears no lateral horn at all.

The attention given to this curious larva heretofore is far less than it deserves. The early stages are entirely unnoticed.

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

Egg.—Elliptical, flat, reticulations distinct in the empty shell, linear, triangular, quadrangular, rarely pentagonal, irregular; transparent, colorless, the shell white; size $1.6 \times .9$ mm. Laid singly on the under side of a leaf.

Stage I.—(Plate IX, fig. 1) head whitish, eye black; body elliptical, dorsal space broadest anteriorly, gradually narrowed to the tail, not

narrower centrally. Segments fairly well marked; skin perfectly smooth. A subdorsal and a lateral row of thick processes with an apical seta and radiating crown (Plate IX, fig. 2) the terminal half of each more slender than the basal half and with an enlarged tip. There are eleven of the horns in the subdorsal row (joints 3 to 13) and nine in the lateral row (joints 3, 4, 6 to 12), all about alike in size. The subdorsal row stand at about 45° with the body, the lateral row are horizontal. Color whitish, a faint, more opaque yellowish tint on joints 6 to 9 centrally. Length 1.1 mm. The larva does not feed.

Stage II.—Horns shaped much as before, but covered with pale, black-tipped spines with swollen bases as in the mature larva (Plate IX, fig. 6), but only about twelve on each horn. Skin finely clear granular. Dorsal depressed spaces (1) double, small and round. Horns of subdorsal row all alike; those of lateral row on joints 3 and 4 a little longer than the rest, the apical spine setiferous. Dorsal space rather broad, even, rounded at joint 3; lateral space rather large, diminishing at the ends; subventral space very small. Ridges marked by the moderate rounded horns, the subdorsal row projecting rather more than 45° , but not horizontal. The larva is not greatly flattened, both the ridges being prominent. Under a high power the skin appears creased shagreened, almost scaly, uniform. Color ground glass white, immaculate, except the black tips of the spines. Length 1.1 to 1.8 mm.

Stage III.—Elliptical, gently flattened; dorsal space rather narrow, of even width, lateral space broad, oblique, diminishing at the ends; subventral space small, contracted. Horns subequal, slender, tapering, conical, the subdorsal ones extending at about 60° , the lateral horizontal; spines slender, short, with small black tips. The subdorsal horn on joint 13 and the lateral ones on joints 3 and 4 are a little larger than the others. Skin closely shagreened, as if the granules were appressed and concaved instead of convex as usual. Color light yellowish green, the horns paler; a pale yellow line along the subdorsal ridge, straight, faint at the ends, the pair connected by a faint bridge on joint 9. Length 1.8 to 3.2 mm.

Stage IV.—Elliptical, flattened; subdorsal horns considerably shorter than the lateral ones, all slender, tapering, the pair on joint 13 larger. Dorsal space narrow, a little wider at both extremities. Color pale green, a faint yellow line along the subdorsal ridge with a little red dot in the bridge at joint 9. Horns paler, the subdorsal on joint 3 and lateral on 3 and 4 have reddish tips. There is some light green pigment in the dorsal space, supplementing the color of the blood. An

obscure raised area down the anterior side of each segment; lateral depressed spaces (4) and (6) show as white dots. Dorsum evenly shagreened, the white paired dots (1) visible on joints 3 and 4, and 4 and 5. Length 3.2 to 4.4 mm.

Stage V.—Similar to the mature larva in shape, subdorsal horns projecting horizontally, only half as long as the lateral horns, those on joints 8 and 10 slightly shorter, that on joint 13 longest; all slender, fringed by the black-tipped spines. Skin wrinkled shagreened, the horns also wrinkly. Yellowish green, the yellow subdorsal line broad, a red dot on joint 9 anteriorly. Subdorsal horns of joint 3 and lateral of 3 and 4 red throughout, the subdorsal pair on 3 connected by a faint red line. Other subdorsal horns yellowish green, the one on joint 9 more distinctly yellowish. Lateral (4) and lower intersegmental lateral (6) dots visible as before. Length 4.4 to 6 mm.

Stage VI.—Flattened, dorsal space narrowed centrally at joints 7 to 11. Subdorsal horns one-third the length of the lateral ones, those on joints 8 and 10 shorter, all flattened, projecting horizontally. Color green, the dorsal space pigmented. Dots of depressed spaces (1) double and paired on joints 3 to 4, elsewhere scarcely indicated. On the sides a green line on the anterior side of the segments, the posterior part whitish and containing a large reniform glandular spot (4), a large round green centered one (6) and a small white dot (5) on the green band below. A yellow line on the subdorsal ridge, a central red dot on joint 9 surrounded by yellow. Anterior horns dark red as before, joined by a red stripe and armed by black spines. The other horns pale and armed as before. The black spines differ only in color from the others. Skin covered with long waved ridges instead of granules. Length 6 to 8.3 mm.

Stage VII.—Essentially as before, and also closely like the mature larva. Color green, a red dot on joints 9 and 11 anteriorly between the yellow subdorsal lines; front edge red as before with short black spines. Some of the spines of lateral horns bear long setæ instead of short tips, and thus cause a more fringed appearance. Length 8 to 12.6 mm.

Stage VIII.—(Plate IX, figs. 3, 4, 5 and 7) Shape as described above. Green, pigmented in dorsal space and on the raised bars along the anterior edge of the lateral segments. Glandular dots whitish, the spots on the sides (4) and (6) surrounded by some green pigment and appearing as broken whitish rings with dark centers. Anterior edge red, rarely also the tips of all the horns. A distinct yellow subdorsal

line running onto the horn of joint 13. Red marks on joints 9 and 10 usually broken into paired dots, sometimes supplemented by smaller dots on joint 12. Dorsal depressed dots (1) and (2) small, paired, distinct. Spines as before, the skin coarsely creased as in the previous stages. Length 12.6 to 18.5 mm.

Food-plants.—Chestnut, oak, beech, elm, maple, hop hornbeam, hickory and linden have been observed.

EXPLANATION OF PLATE IX.

Fig. 1. Larva in stage I, side view, enlarged.

" 2. One of the tubercles of stage I, further enlarged.

" 3. Mature larva, side view enlarged.

" 4. The same, front view.

" 5. The same, dorsal view.

" 6. Portion of the lateral area of one segment, showing the skin sculpture, the three depressed spaces (the upper one (4) only in part) and the lateral horn with its spines—enlarged; anterior side to the right.

" 7. Dorsal view of the mature larva showing all the depressed areas except (4), which are nearly completely hidden beneath the subdorsal horns.

" 8. Feeding traces of the larva on a black oak leaf, in stages II and III.

" 9. *Sisyrösea textula*, female.

" 10. The same, male.

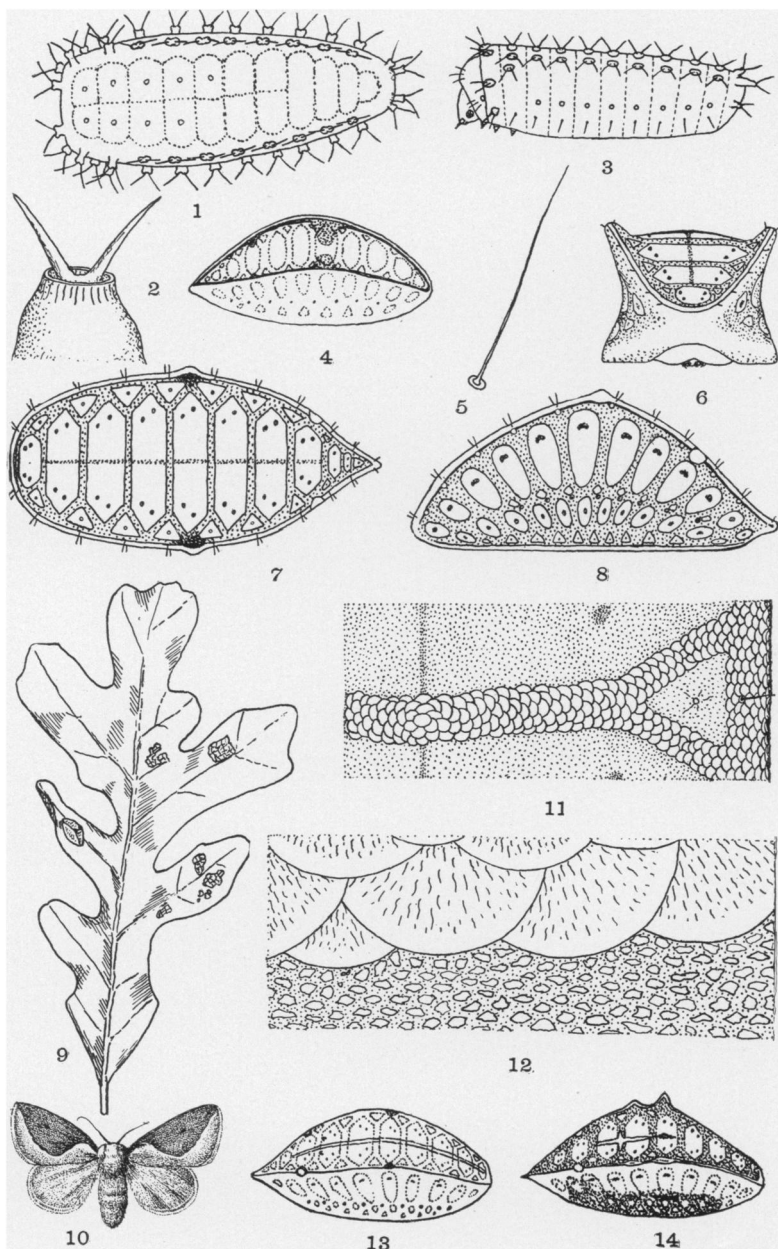
ADDITIONS TO THE LIST OF LONG ISLAND SPIDERS.

BY NATHAN BANKS.

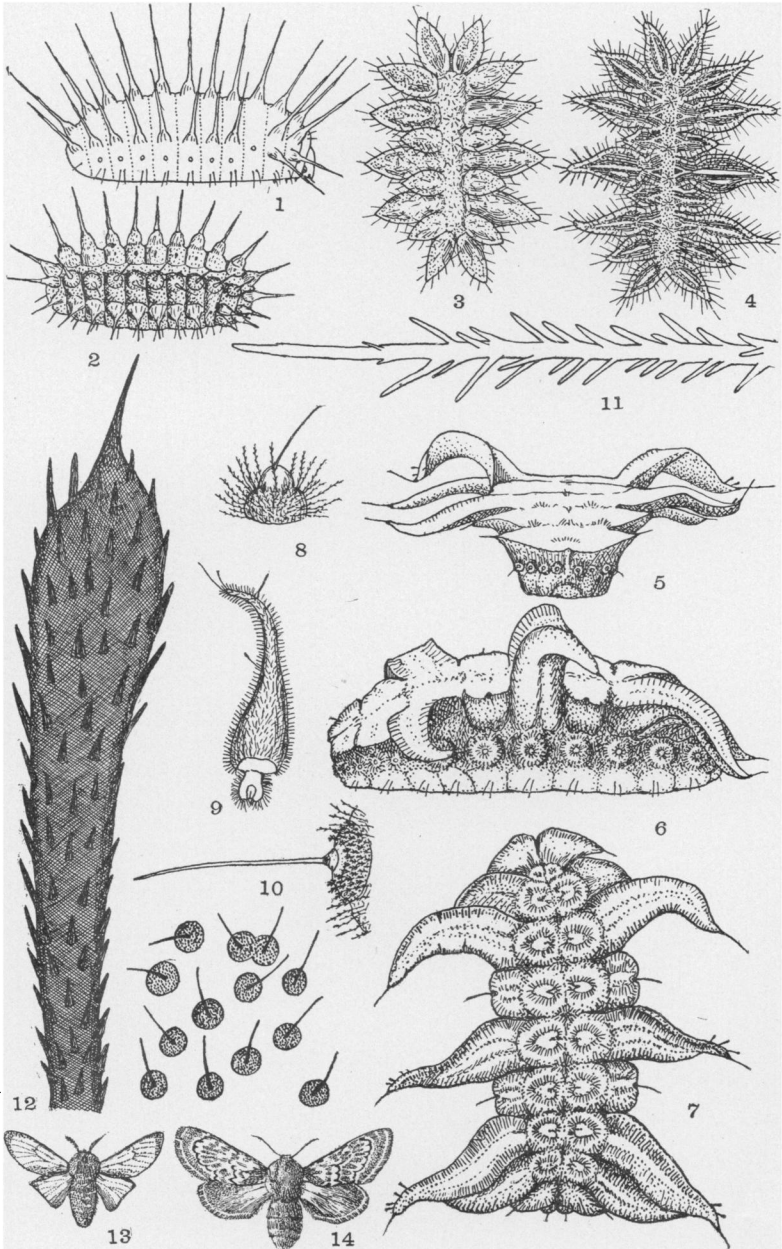
Since the publication of my list of Long Island spiders (Journ. N. Y. Ent. Soc., Vol. III, pp. 76-93), I have discovered several species not previously known from the locality, and a few species that appear to be new. These bring the total number of spiders up to 276. Almost as interesting as the discovery of a new form is that of a rare one. Of that little Oonipid, *Orchestina*, I now have several specimens of both sexes. *Gayenna fraterna* is now known to me by another ♂. Both sexes of *Agræca minuta* have been taken not uncommonly in May and June. Another male has been taken of *Cornicularia minuta*. *Hyctia pikei* is not very rare on salt-grass at Bayville. The species new to the list are as follows:

DRASSIDÆ.

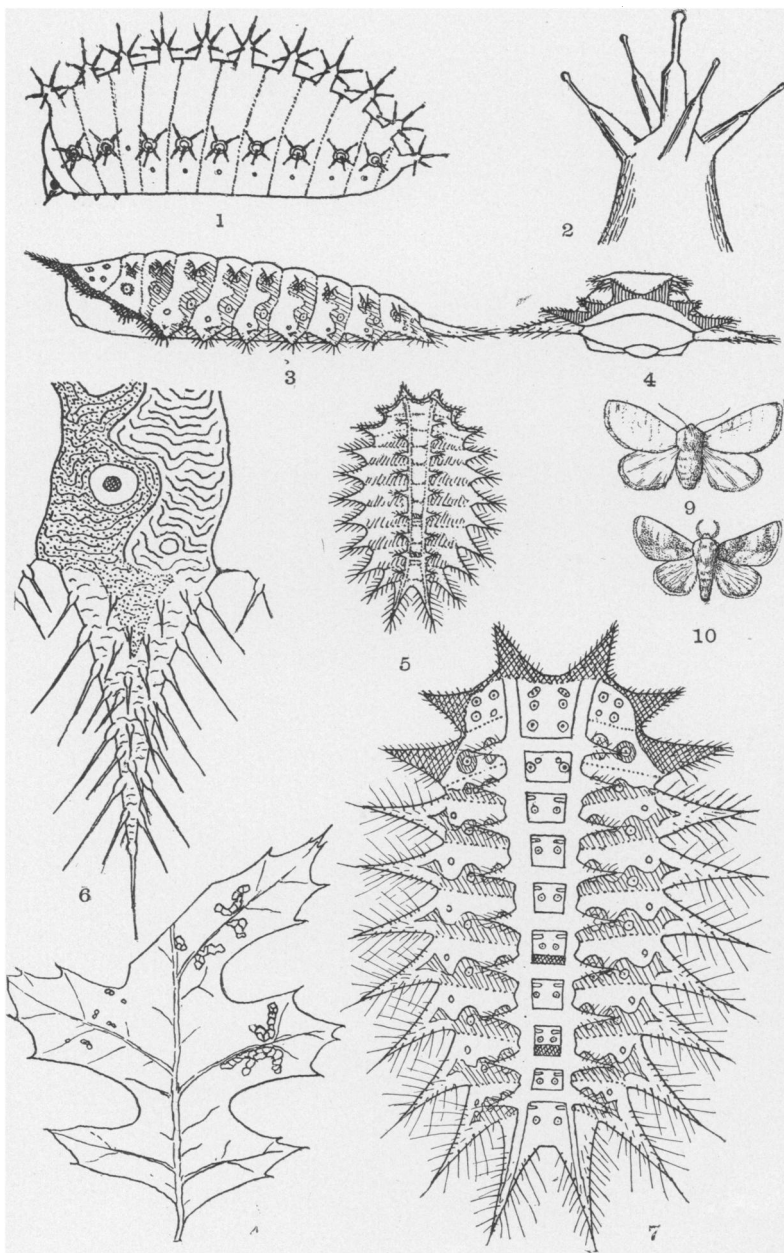
Prothesima, sp? An immature ♂ from among dead leaves in Oc-



Life-History of *Eulimacodes scapha*.



Life-History of *Phobetron pithecium*.



Life-History of *Sisyrosea textula*.